Business Model Patterns and Sustainability

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Contents

1 Basics on Institutionalisation Processes

1.1 Dynamics of the Levels of Our Technology Definition

Technology was defined in the lecture as interrelation of

- globally available *procedural knowledge*,
- *institutionalised procedures* ("state of the art") and
- private *procedural skills*.

The dynamics of these levels are closely linked:

1. Private procedural skills are based on institutionalised practices from which *justified expectations* are derived.
2. The use of private procedural skills leads to *experienced results*. Comparing them with justified expectations influences the institutionalisation of practically successful actions as proven practices.
3. This empiricism is *condensed and generalised* as procedural knowledge extending it with appropriate conceptual systems, which in turn has an influence on the further development of "reasonable" practices and their forms of institutionalisation as *contexts of justification*.

1.2 Transformation of Practically Proven into Proven Practices

The transformation of what is practically proven into proven practices follows a general line:

1. Procedures are standardised as processes and enhanced with appropriate conceptual systems and thus become comparable.
2. Tools are developed to support the operation of these processes.
3. Problems in the operation of these procedures are analysed, solutions are generalised, the practically proven is condensed into *patterns* and further into standards, norms and the *state of the art*.

The generalisation of isolated practices into patterns also plays a role in the TRIZ process model (Fig. 1): Darrell Mann's *Select* phase draws on these generalised experiences, which, however, for the TRIZ *user* only play a role as proven practices. Scientific elaboration means both empirically to consolidate these proven practices and to integrate them into broader contexts of justification and to develop corresponding conceptual worlds.

1.3 Patterns and Contexts

These forms of institutionalisation are embedded as initially domain-specific patterns in a *domain-specific* methodology, for example as industry sector-specific standards and thus are *contextualised*. These patterns can be further generalised to cross-domain standards such as the APQC PCF as a Cross-Industry Process Classification Framework [2]. However, this is also *not universally valid*, but contextualised itself, as it still refers to organisations of a specific-general design.

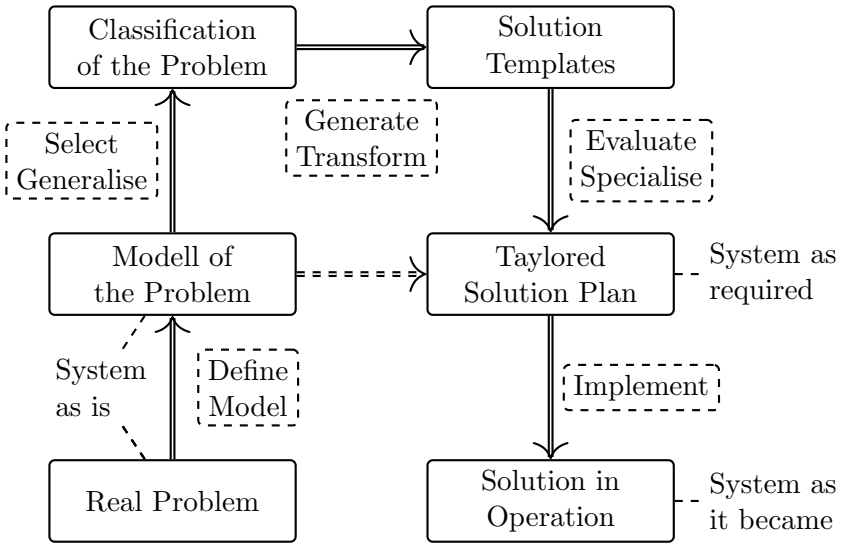

Fig. 1: The TRIZ Process Model

1.4 TRIZ and Patterns

TRIZ is similarly structured. It comes with a toolbox of problem-solving patterns (Select in [10])

- Inventive principles
- Separation Principles
- Inventive standards for SF models
- Evolution patterns of technical systems
- Evolution trends
- Functional-analysis based trimming,

but assumes a specific type of modelling (Define in [10]) with

- Systemic delimitation
- Ideality
- Focussing of an operative zone
- Action and evaluation parameters in functional modelling
- Description of problems as contradictory behaviour of evaluation parameters when action parameters change.

Only on the basis of this (Define) the (Select) is possible. It is also not only a matter of *selecting* the patterns suitable for the solution, but also of *selecting proven applicable methodological procedures* that are based on the respective patterns.

2 Development of Business Process Modelling

When we talk about Business TRIZ today, we are talking about a similar development of institutionalisation of structuring procedures in the area of business processes. In the context of P-TRIZ (Seminar on 9 May 2022), we had identified three stages of that development.

1. With the transition to more advanced forms of industrial production at the beginning of the 20th century, individual work processes were deconstructed, charged with forms of description and assembled into new "living" systems – the *assembly line system* of modern industrial production. The control of the complex interrelationships in such an organisation remained as "art of management" beyond the realm covered by these structural standardisation of work processes.

Together with this institutionalisation complex engineering disciplines such as process engineering or automation technology emerged, which are concerned not only with the processes themselves, but also are developing the tools (understood in a comprehensive sense) that have been and are being used in the context of this institutionalisation.

With its procedures and patterns, classical TRIZ aims at problem solving in this area. It can be applied only if the concrete application domain is conceptually penetrated to such an extent that the specific type of modelling required in the TRIZ analysis phase can be carried out. In this sense TRIZ is a "scientific method".

"Management" remains an art, as for example in "Mintzberg on Management" [11]. Certainly an artist must master the *technical procedures* of his subject, but the practical combination of such techniques remains at the level of private procedural skills.

2. Since the 1960s, the structuring of procedures in the operational management of individual companies has gained in importance as *business process modelling*.

These institutionalisation processes are not possible without the preceding institutionalisations of the technical core processes and build on them.

Howard Smith [15] stated in 2006 that these institutionalisation processes are well advanced with the development and widespread use of computer-based Business Process Management (BPM) systems and the establishment of uniform conceptual systems such as the APQC PCF [2]. According to Howard Smith this allows to move on to the next level, to *P-TRIZ*.

> P-TRIZ is the application of modern TRIZ towards business process improvement, innovation, and transformation. Coupled to BPM methods, it provides the engineering discipline that amplifies the creativity of those who seek to re-design processes. [15]

3. In the management literature, this level of institutionalisation of structuring in intercompany cooperation has since been roughly associated with the term *Business Model*. It is based on the forms of institutionalisation of intra-company operative business, but did not develop as quickly as Howard Smith expected in [15].

3 Business Process Models and Business Models

3.1 Business Process Models

The confusion between these two levels of generalisation is also reflected in the literature consulted for the seminar. In [4], "business process model patterns" are examined, which are defined as

> the description of a proven solution to a recurring problem that is related to the creation or modification of business process models in a specific context. This description is typically organised in a structured document supporting the reader in understanding under which circumstances the proposed solution will be useful (ibid, p. 974),

The authors clearly emphasise that

> in economics the term *business model patterns* is used for a pattern describing the economic principles of an organisation [...] Although business model patterns can be depicted visually, they were not considered in our survey due to their specificity on the economics perspective.

The aim of [4] is described as to "discuss patterns related to various aspects of process modeling" (ibib, p. 981). Hence even 15 years after [15], the third phase of the institutionalisation of patterns is still a prominent topic as a central component of problem-solving in the field of Business Process Landscapes of operational management.

Patterns are understood in the sense of Christopher Alexander's architecture patterns [1] or the Software design patterns of the "Gang of Four" [5]:

> A pattern is a combination of a problem and a corresponding solution that is described in a systematic and generic way, so that it can be used over and over again in different situations. [8, p. 3]

This is not exactly the same as principles, evolutionary lines or trends in TRIZ, as in these approaches there is no direct link between problem and solution, but the "TRIZ model of the system as it is" is used as starting point for selecting a systemic transformation pattern first to design the solution in general and then to concretise it with available resources (phase *Select* in [10] – see the descriptions of the different *Problem Solving Tools* there). These tools are nevertheless also subsumed as "patterns" below.

Business TRIZ has a similar focus as business process models in many practical applications in which it has to resolve contradictory objectives in the operational organisation of the company. However, Business TRIZ does not look for new patterns, but tries to transfer the patterns known from the technical field to this field and adapt them on the basis of new domain-specific experience. Such a transfer may seem suspicious at first glance. However, it can be observed that essential instruments of classical TRIZ, such as, e.g., the Patterns of Evolution of Technical Systems, are based on observations on market processes and developments as explained in more detail in [7] and thus have a certain relevance not only for the level of Business Process Management Systems but also for the level of Business Models.

3.2 Business Models

The level of business models has been studied more intensively since around 2010. In a first overview [16] the authors observed "that scholars do not agree on what a business model is, and that the literature is developing largely in silos, according to the phenomena of interest to the respective researchers". They present a list of eight different definitions of the notion of a business model and identified emerging common themes among scholars of that area:

1. The notion of business model is emerging as a new unit of analysis.
2. Business models emphasise a system-level, holistic approach towards explaining how firms "do business".
3. Firm *activities* play an important role in the various conceptualisations of business models that have been proposed.
4. Business models seek to explain how value is created, not just how it is captured.

This strong orientation of business model (patterns) towards value creation plays a central role in [12], [16], but also in the much-cited reference [6]. Despite such a relatively homogeneous focus, however, no generally accepted "Pattern Database" has yet emerged. One problem is, of course, the focus itself, since *value proposition* is oriented towards a functional property of the components and not towards a functional property of the network, whose *main useful function* should be an emergent function of the network as a whole according to the theoretical approach of TRIZ.

4 Business Models and Sustainability

In this sense, the concept of sustainability is a touchstone to what extent Business Model Pattern taxonomies can address topics beyond such a narrow focus.

Today's inclusion of sustainability issues in business models is largely the result of a longer-term politicisation of this issue.

4.1 Sustainability Emerging as Business Goal

The importance of sustainable and ecological aspects in management has been a topic of public awareness at least since the reports on the *Limits to Growth* by the Club of Rome. While in the early years the debate focused on the finiteness of available natural resources and thus on longer-term development aspects of availability of a *material basis* (such as "Peak Oil"), in the last 20 years it has become increasingly visible that global *processes* (such as "climate change" or "extinction of species") will leave established ranges much earlier if the currently active industrial mode of production which is the basis of our prosperity will be followed up without substantial changes.

In contrast to other globalisation processes such as, e.g., the implementation of Intellectual Property Rights, these processes do not originate and were not driven by individual interest groups, but have the *cooperative action* of an inherently global "thinking community" of a networked, interdisciplinary science as their basis. The problematisation was initiated and formed by transnational political bodies and today plays an increasingly important role in

the framework of international political affairs. The formula "think globally, act locally" nevertheless expresses that those global challenges can only be met through changed local action. Corresponding awareness-raising processes at the socio-cultural and political level have meanwhile reached such a degree that at least a financially potent middle class bases its economic decisions also on ecological and social issues.

With the 17 Sustainable Development Goals (SDG) adopted in 2015 by the UN, the politicisation of this issue has reached a new dimension, as these goals anchor long-term objectives of necessary changes with today's cooperative actions.

Sustainable Development Goals

Triple Bottom Line

4.2 Sustainability and Business Models

In the business environment and more general socio-economic debates, this politicisation is anchored with the slogan of the *Triple Bottom Line: Planet – People – Profit* [3]. It obviously reveals massive contradictory dimensions in the inclusion of ecological (planet) and social (people) goals into economic processes.

Even if such a narrative is being further refined today with the PESTLE approach (addressing the political, economical, social, technological, legal and environmental dimensions), in view of the value orientation of Business Model Pattern taxonomies so far, a consistent orientation towards all three "P" can hardly be expected.

This main focus on value propositions is emphasised in [8] in the introduction to the survey citing [14]:

> A business model for sustainability "helps describing, analyzing, managing, and communicating
>
> (i) a company's sustainable value proposition to its customers, and all other stakeholders,
> (ii) how it creates and delivers this value,
> (iii) and how it captures economic value while maintaining or regenerating natural, social, and economic capital beyond its organizational boundaries".

The authors extraced 45 patterns from the literature on Sustainable Business Models and grouped them into 11 pattern groups

G1 Pricing & Revenue Patterns (4 patterns)
G2 Financing Patterns (3 patterns)
G3 Ecodesign Patterns (4 patterns)
G4 Closing-the-Loop Patterns (9 patterns)
G5 Supply Chain Patterns (6 patterns)
G6 Giving Patterns (2 patterns)
G7 Access Provision Patterns (6 patterns)
G8 Social Mission Patterns (5 patterns)
G9 Service & Performance Patterns (4 patterns)
G10 Cooperative Patterns (1 pattern)
G11 Community Platform Patterns (1 pattern)

As example the patterns in the group *Pricing & Revenue Patterns* are listed:

- Differential Pricing
- Freemium
- Innovative Product Financing
- Subscription Model

According to the pattern definition for each of the patterns context, problem and solution are described and an example is given, e.g. for *Differential Pricing*

- *Context:* Base of the Pyramid and low-income groups in both developed and developing countries are often excluded from consumption due to price barriers.
- *Problem:* Customers might need the same product but have different payment thresholds. Hence, some customers are either unwilling or unable to pay as much as others for the same product.
- *Solution:* Charging groups with higher payment thresholds higher prices to subsidize those groups who cannot afford to pay as much.
- *Example:* [Novo Nordisk] sells insulin in developing countries at prices that are up to 20% below the mean prices charged in developed countries.

The example shows very well the structured approach (the patterns are available in RDF notation in the WUMM database), but also the extensive orientation towards new and flexible forms of value proposition, which are driven more by new possibilities which emerge within digital change than by questions of sustainability. This is also emphasised in [13, p. 3]:

> General purpose idea generation tools do not usually show any specific preference to sustainable aspects, since their overall purpose is product success and the identification of unexplored market opportunities. Therefore, the attention to sustainability is random, not taken for granted and presumably dependent on designers' sensibilities towards environmental and human problems.

5 Eco Design Principles

5.1 Lifecycle Orientation and Eco Design Principles

The approach in [13] is very different. Over several years the authors worked out and consolidated *Eco Design Principles* (EDP). The focus is not on Business Models but on the Product Lifecycle and thus on *material processes* in their full complexity. Even if "market success as key for any eco-design product" [9, p. 1] is emphasised, the EDP are primarily directed at the early phases of product design. Hence it is difficult to assess the impact on "value proposition" and market success. See [9] for an evaluation of such aspects.

The general orientation of EDP is described in [13, p. 3] as follows:

> During design phase, each designer is supposed to follow a list of guidelines and accordingly modify the existing product to make it more environmentally friendly. The crucial point is to exploit problem solving strategies as a framework for eco-guidelines that guide the user to make product development, taking into account first of all sustainability objectives.
>
> It is important to understand that problem-solving tools are not easy to learn, so a strong simplification is needed to guide non-experts. Unlike a structured problem-solving method that involves a preliminary phase of understanding and modeling the problem, an eco-guideline acts exclusively as an inventive trigger. Therefore, it must be both simple to understand and effective.

The aim of the EDP presented in [13] is "the customization of a set of tools that are typical of the TRIZ methodology. Almost all suggestions are based on TRIZ tools [...] However, TRIZ is not a method born to do Ecodesign and, therefore, there has been a long work of selection and adaptation of individual instruments. Only those instruments leading to solutions with less waste of resources have been chosen."

16 generic strategies are derived,

1. Switch to super system
2. Trimming
3. Dematerialization/ideality
4. Merging
5. Redesign the internal structure
6. Change the state of aggregation
7. Local quality
8. Substitute
9. Segmentation of the parts/components
10. Design for Assembly
11. Dynamics
12. The Other Way Around
13. Taking out
14. Increase control
15. Recycle/Reuse
16. Optimize

to which the identified 59 Eco Guidelines are assigned. Each of these generic strategies is embedded in the TRIZ methodology and their solving power is outlined without, however, assigning them to a problem.

Example: Strategy 2 *Trimming*:

> Trimming is a good technique for making greener products. It consists of making a product constituted by fewer parts, with positive consequences on many aspects of the product life cycle, from the management of warehouse orders, storage, transport, as well as on reducing the mass. In order to achieve the maximum environmental benefits, it is preferable to start by eliminating those pieces having the highest impact on the environment. When a component is deleted from the system, it is better to try to exploit the resources already available in the super-system to replace its useful function.

The authors emphasise that they "have worked on the mechanisms of activation of creativity that are typical of the TRIZ methodology, trying to translate it into guidelines bypassing every step of problem definition." This is clearly different to the "pattern approach" as developed, e.g., in [8].

The description of each principle contains a detailed *Generic Suggestion*, more structured *specific suggestions* and examples.

Similar to [6], the individual EDPs are also assigned values from a morphological table with the attributes *when, action, what, how.*

- *When:* Premanufacturing, Manufacturing, Use, End of Life
- *Action:* Eliminate, Reduce Mass, Reduce Volume, Reduce Quantity, Reduce Distance, Improve Durability, Select Other.
- *What:* Raw materials, External logistics, Internal logistics, Packaging, Machineries, Auxiliary materials, Components, Emissions, Energy.
- *How:* Generic suggestion, Resources list, Example.

The general pattern of a guideline is formulated as

> (WHEN) you want to intervene, (ACT) on components (WHAT), by doing something (HOW) and using one resource (from the Resource list) to find alternatives and assess environmental impacts.

In [13, Fig. 2] the following sample of a guideline is given:

> During supply task (WHEN – Premanufacturing),
> reduce the mass (ACTION – Reduce mass)
> of the raw material (WHAT – Raw material)
> by recycling waste material in your facility to make it new raw material for the product (HOW – Generic Suggestion).
> See list of structural resources (HOW – Resources list)
> In order to reduce the mass of the casting metal, the casting channels can be re-used for successive melting (HOW – Example)

5.2 Eco Design Principles – A Survey

The authors of [9] conduct a literature survey on this topic. At the beginning, the difficulties to be overcome are worked out.

> The literature review has elucidated several conflicting viewpoints on the relationship between success and eco-design implementation:
>
> (i) Environmental-friendly strategies applied to product design are a critical factor to achieve success.
> (ii) Many new environmental-friendly products fail to achieve success and, therefore, sustainability goals.
> (iii) The implementation of EDPs often conflicts with other product characteristics, resulting in the worsening of performance or the increase of costs.
> (iv) Given the uncertainties about the adoption of new environmental-friendly products, these products have to clearly outperform their predecessors to be worthwhile.

Under the heading "Selection of potentially environment-friendly products" four sources with altogether 310 products are analysed. Based on this analysis 66 EDPs are distinguished, giving a short description and assigning them to the examples. Table 3 list six such examples in more detail. One of the examples is reproduced below.

- *Product:* FRIA refrigerator, Ursula Tischner: fridge built into the external wall to use the winter cold.
- *Assigned EDPs:*
  - P16 Minimize energy consumption ginitemize
  - P18 Select non-toxic and harmless energy resources
  - P46 Reduce auxiliary components ginitemize
  - P48 Reduce environmental problems during the product use
  - P52 Reduce the consumption of energy required
- *Explanation:*
  - 'It was calculated that in typical German house it could work for about 3–5 months a year without consuming any energy (P16, P46 and P52).'
  - 'All in all the energy payoff is potentially remarkable: the FRIA uses at most half the energy of a modern fridge; there is no CFC usage; and energy waste, up to 80% in a normal fridge, is removed through FRIA's integration into the building's fabric (P16, P18 and P48).'

For each of the examples, the market success is examined and this is evaluated on a 7-level scale. The example given above is assigned to level 1.

> It is not yet on the market, although the project dates back to 1994, because it would cost about 3,000 Euro [...] The market does not seem to want it.

6 Summary

The three papers show the difficulty of embedding ecological principles in general or environmental friendliness in a narrower sense in a business culture which is primarily measuring based on economic parameters.

The SBM approach seems to be rather counterproductive, as it tries to translate changed consumer behaviour and thus the politicisation of the environmental problem into business models without making visible if this leads to changes in the productive base. In many cases it looks like seekng new *value propositions* to a prolongate an old mode of production.

The EDP approach addresses the problem from the material side by taking "planet" and "people" into account at an early stage of product development. It is emphasised that TRIZ is particularly suitable as a methodology here, as it supports both a systemic focus and provides powerful tools for analysing and resolving contradictions. In [9], however, the following tradeoff is emphasised:

> The literature has hitherto focused on conditions and actions facilitating the success of sustainable development initiatives at the company, business and industry levels, but the *product dimension*, e.g. what is changed in the product structure or in its provided benefits, has been taken into consideration only in user experience studies.
>
> This is of particular importance – the application of EDPs might lead to changes in the products' structure, interaction with users, esthetics, affordance, etc. The product perception is therefore modified, boosting or undermining success chances. However, in the early design phases, the product as a complex whole is not developed enough to be experienced and evaluated.
>
> On the one hand, EDPs are the only guidelines that a designer can apply in the early design phases when environmental friendliness is in play. On the other hand, methods that improve the acceptability of a product can only be exploited in the final stages of product development. This implies that knowledge to support the early design stages is lacking when the aims are both improving environmental performances and increasing success chances.

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